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ABSTRACT

This study investigated the contributions of the professional qualification of biology teachers, laboratory facilities, and biology textbooks to the teaching of biology in 10 government and 10 harambee schools in Kenya. Biology is currently a compulsory subject in all secondary schools in this country. Data were obtained from questionnaires administered to curriculum developers, head teachers, biology teachers, biology laboratory assistants, and students in form four schools. (These questionnaires are included in appendices.) Findings indicate that the more professionally qualified the teacher in a given school the better the performance of students in such a school and that the availability of laboratory facilities helped students understand certain concepts learned in theory classes. Students also performed better in schools which had many different types of textbooks available to teachers and students. In addition, students performed better in schools in which they did not have to share their textbooks. Several recommendations based on these and other findings are offered. One recommendation is to supply syllabi and teaching guides to all schools, especially those with untrained teachers. (JN)

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African Studies
in Curriculum Development & Evaluation

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No. 80

JOHN O. OTEWA:

FACTORS
AFFECTING THE TEACHING OF BIOLOGY
IN BOTH GOVERNMENT AND HARAMBEE
SECONDARY SCHOOLS IN KENYA.

AGO Project

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THE FACTORS AFFECTING THE TEACHING OF BIOLOGY IN BOTH GOVERNMENT AND HARAMBEE SECONDARY SCHOOLS IN KENYA

BY

OTEWA JOHN ODHIAMBO, B.ED.

1983

SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL ADMINISTRATION, PLANNING AND CURRICULUM DEVELOPMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE DIPLOMA IN CURRICULUM DEVELOPMENT.

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DEDICATION:

This paper is dedicated to my dear parents and the brother who took care of my Education

and

to my wife, Atieno Florence and my two daughters, Faith and Rachel.

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TABLE OF CONTENTS:

	pages
1. LIST OF TABLES	iv
2. THE STATEMENT OF THE PROBLEM	1 - 4
3. THE PROCEDURES	5 - 8
4. THE ANALYSIS OF THE DATA	9 -15
5. SUMMARY AND CONCLUSIONS	16 - 21
6. APPENDIXES	22 - 31
7. FOOTNOTES	32
8. BIBLIOGRAPHY	33

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LIST OF TABLES:

	pages
1. Comparative performance in biology and Christian religious Education in 1982 K.C.E in some chosen schools in South Nyanza District	2
2. Number of schools in South Nyanza District	5
3. Names and status of schools visited in South Nyanza District	5-6
4. Relationship between the professional qualification of teachers and the percentage pass in 1982 K.C.E Biology in their respective schools	9
5. Relationship between the laboratory facilities and the performance in biology at K.C.E level in 1982.	12
6. The effects biology text books have in the performance in biology, K.C.E 1982	14

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CHAPTER ONE

THE STATEMENT OF PROBLEM:

INTRODUCTION:

Biology is one of the Science subjects taught in secondary schools in Kenya, from form one to form six. The government has been trying to encourage the teaching of science subjects in the secondary schools. This has been because the science subjects like physics, chemistry and biology form the basic needs for industrial and agricultural development of the nation.

Despite the emphasis put on these subjects by the government, it has been observed that most schools enrol few candidates for physics and chemistry.
Further, most candidates generally have poor performance in the science subjects at the Kenya Certificate of Education level, (K.C.E). Performance in sciences in Nyambee secondary schools is worse.

The objective of this study was to investigate the contributions of the professional qualification of biology teachers, laboratory facilities and biology text books in the teaching of biology which is currently a compulsory science subject in all secondary schools in Kenya. The investigation was done in South Nyanza District in Kenya.

BACKGROUND:

Kenya, a developing and agricultural country needs to develop in areas like agriculture, medicine, veterinary, forestry and other technical fields.
All these fields demand some scientific knowledge. This has made the country to emphasize the relevance and importance of science subjects like Biology to the youths in secondary schools to enable them participate fully in the national development of the country.

The Government's needs for future scientists have been evidensed by the fact that, from early 1970s the colleges that were training secondary school teachers for both arts and science subjects were converted to train mainly the science teachers. It was only Nairobi University main campus and Kenyatta University College campus that were left to train both science and arts teachers at graduate level. Kenyatta University College campus was also producing diploma teachers. Three other institutions were involved in the production of science teachers like Kenya Science Teachers College, Kenya Technical Teachers College and Egerton College. The three colleges had been producing S1 teachers but currently they

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have been made to produce science diploma teachers for secondary schools.

It has been observed that employers which recruit secondary school leavers emphasize in their requirements credit passes in sciences like "the candidates should be holders of K.C.E. Division three with at least a credit pass in science subject."[1]
Most of the post secondary colleges are science based except teachers training colleges. The science based colleges include medical training centres, Agricultural Colleges like Ahiti, the training college in water science in Nairobi and polytechniques. All these show social changes in demands in favour of sciences.

The problem is a cute in Kenya because after secondary Education very few students go for further studies either in high schools, 'A'-level or University due to lack of spaces in such institutions - majority of secondary school leavers are left either to get into some college, get direct employment or remain as floating drop outs who flood the streets of most Urban centres in the country.

Despite all these demands of the society about sciences, it has been the greatest problem to the country that the youths in secondary schools perform poorly in science subjects.
Harambee Schools that cater for about 60% of the secondary schools students population in the country have very poor background in the teachings and learning of the sciences.[2] Table one below shows the comparative performances in Biology and Christian Religions Education in 1982 Kenya Certificate of Education in some chosen schools in South Nyanza.

COMPARATIVE PERFORMANCE IN BIOLOGY AND C.R.E. TABLE ONE

	The School	Status of the School	% Pass in Biology	% Pass in C.R.E
1.	Rapogi boys	Government	63	90.6
2.	Homa Bay boys	Government	72	93
3.	Kanyawanga boys	Government	45	62
4.	Nyabisawa Girls	Government	51	74
5.	Asumbi Girls	Government	64	79
6.	Kadem Girls	Harambee	13.6	50
7.	Kakrao Mixed	Harambee	27	50

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In culculating the percentage passes all students who had pass eight in both subjects were regarded to have passed and the percentage pass was culculated as follows:-

$$\% \text{ pass} = \frac{\text{No. of students with at least pass 8}}{\text{Total no. of students who took that paper}} \times 100$$

The above table confirmed that biology has been poorly done compared to arts subjects like Christian Religious Education. Since biology is the only science subject which is taken by all students at secondary level in the country it became necessary to the investigator to investigate the contributions of certain factors in the teaching of biology which is taken as the subject that determines the future training and employment of Kenyan youths at secondary level.

THE OBJECTIVES OF THE STUDY:

As indicated in table one above, performance in the science subjects by students has been rather poor in secondary schools in Kenya. This has necessitated the formulation of the following basic objectives of the study:-

1. To investigate the effects the professional qualification of a teacher has in the teaching of biology.
2. To investigate the part played by laboratory facilities and biology text books in the teaching of biology.

THE SIGNIFICANCE OF THE STUDY:

The study of science in the developing world or countries has a lot of significance. For this particular study the following are some of the significant points about it:-

(a) The science subjects form the foundation of the technical, agricultural and industrial development of the country. Biology is a science subject that leads its scholars into fields of Agriculture, Veterinary, Medicine, Forestry, Food Science and Technology and other biological oriented disciplines. All these areas form the backbone of this country's economy. The Government has therefore to see into it that the performance in these subjects like biology is good.

(b) About 60% of Kenyan youths in secondary schools are found mainly in harambee schools[3]. The performance in sciences in such schools has been comparatively low. If the performance is left to remain low the country stands a chance of having low agricultural, industrial and technical development. This can then lead to low economic development in future from the citizens.

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The country may then be forced to import expertriates in order to achieve the demands of the society while the citizen remain unemployed.

(c) In Kenyan Educational system secondary schools are graded into A, B and C. This grading is done on the basis of, among other things, the performance in sciences. This then means that the success of sciences in the schools is vital especially to schools which have not been graded like the coming up harambee schools.

(d) The information received from the study may be used by the Government to improve the teaching of sciences especially in harambee schools so as to cater for the future of many Kenyan youths in such schools.

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CHAPTER TWO

PROCEDURES:

A: Sample Selection:

The actual research work covered only the schools in South Nyanza District, although the title of the paper covers the whole of Kenya.

The South Nyanza District has twenty government schools and twenty five harambee schools including the missionary schools. Due to financial and time limitations the research was carried in ten government and ten harambee schools as shown in table ~~three~~ two below.

Table T w O: Number of schools in South Nyanza District.

SECONDARY SCHOOLS	TOTAL NUMBER	NUMBER OF SCHOOLS VISITED	% OF VISITED SCHOOLS
Government	20	10	50
Harambee	25	10	40
Total	45	20	44

The selection of schools that were visited especially the Government ones was done by stratified sampling method because the district had different types of schools like National Schools as Homa Bay High; Provincial Schools as Mbita High and district schools as Rapogi High. The major difference among these groups of schools in that National schools select students for forms one and five from all over the country. Provincial schools on the other hand take students from the province in which they are found. District schools similarly take the students from their districts.

The table ~~three~~ below shows the status of the schools which were visited: THE SCHOOLS VISITED IN SNS DISTRICT.

The name of the school	The status of the school
1. Nyabisawa girls high	Government
2. Pe-hill boys high	"
3. Rapogi boys high	"
4. Homa Bay boys high	"
5. Ogande girls high	"
6. Asumbi girls high	"
7. Gendia boys high	"
8. Agoro Sare boys high	"
9. Kanyawanga boys secondary	"
10. Kokuro boys secondary	"

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Table three (continues)

the name of school	the status of the school
11. Kamagambo Mixed high	Private -under the management of S.D.A.
12. Uriri Mixed high	Private -under the management of Catholics.
13. Kakrao Mixed secondary	Harambee
14. Kadika girls secondary	"
15. Kodero bara Mixed sec.	"
16. Dr. Agrey mixed secondary	"
17. Olare mixed secondary	"
18. Kanyamfwa mixed secondary	"
19. Mawego girls secondary	"
20. Magare mixed secondary	"

The target population for the research included the following:

(a) Biology curriculum developer stationed at Kenya Institute of Education.
(b) Head teachers of the selected schools.
(c) Biology teachers in the selected schools.
(d) Biology laboratory assistants in the selected schools which had them.
(e) Some students in form four in the schools selected.

B: Data Collection instruments.

In order to collect the data four questionnaire sheets were designed and were administered to the following groups of target population.

(a) curriculum developer.
(b) Head teachers.
(c) Biology teachers and laboratory assistants.
(d) Form four students.

To the curriculum developer the questionnaire sheet covered the following areas:-

(i) how dissemination of curriculum materials like teachers guides, Syllabi and the like take place from the Institute to the schools and whether all schools receive such materials.
(ii) whether the institute receives feedback from schools regarding the usage of the sent materials.
(iii) the constraints teachers meet in using the materials sent to them from the institute.

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(iv) If teachers have some problems with the materials and what steps does the institute take to solve such problems? The whole questionnaire is attached at the back in appendix one.

The questionnaire sheet to the head teachers seeked for information regarding:

(i) The number of biology teachers in the visited schools.

(ii) The qualification of the existing biology teachers in the school.

(iii) The number of years the form four biology teachers has taken in the school.

(iv) The past years Kenya Certificate of Education Examination results. The full contents of the questionnaire is attached at the back as appendix two.

The questionnaire to both the biology teachers and the laboratory assistants had questions which seeked for the following information:-

(i) The existing laboratory facilities and text books in the school.

(ii) The laboratory facilities and the text books which the schools lacked but the teachers and the laboratory assistants felt were more desirable.

(iii) The means by which the schools were receiving the supplies of laboratory facilities and the books. The full contents of the questionnaire is put in appendix three at the back.

The questionnaire to the students seeked to know the difficulties such students experience in learning biology in terms of:-

(i) Lack of teachers.

(ii) Availability of text books.

(iii) Availability and equipment of the laboratory.

The full contents of the questionnaire is listed in appendix four at the back of the paper.

C: Administration of the instruments.

Letters were sent to the target population like the curriculum developer and the headteachers who were to pass the information to the biology teachers and laboratory assistants. This was hoped to brief them on the purposes of the exercise and to solicite their cooperation and assistance. The letters contained the possible dates of the visits and time was allowed for some schools to choose some other dates that suited them better.

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CHAPTER THREE:

THE ANALYSIS OF THE DATA:

1. The effects the professional qualification of biology teachers has in the teaching of biology.

During the investigation different schools had their head teachers given questionnaires to answer which seeked the knowledge about the number, professional qualification of the existing biology teachers and the past years Kenya Certificate of Education exam results in Biology, Christian Religious Education and History. In twenty schools visited there were the following categories of teachers profession wise:-

(i) Graduates
(ii) S1
(iii) K.A.C.E Untrained.

Some schools were chosen which had relatively the same facilities like laboratory facilities and text books. The professional qualification of the biology teachers in such schools were matched with 1982 K.C.E biology results expressed in percentage pass as explained in chapter two above. This was done with the assumption that any difference in performance in biology was due to the professional qualification of the teacher involved.

The table four below shows the relationship between the K.C.E biology results in 1982 and the professional qualification of the teachers involved.

Table four:

Relationship between the professional qualification of teachers and the percentage pass in 1982 K.C.E biology in their respective schools.

The School	Status of the school	Professional qualification of biology teachers involved	% Pass in biology 1982
1.Ogande girls high	Government	Graduate	73.4
2.Asumbi " "	"	"	64
3.Rapogi boys "	"	"	63
4. Nyabisema girls	"	S1	54
5. Gendia boys high	"	"	51
6. Pe-hill boys "	"	"	40.18
7.Kakrao Mixed Sec.	Harambee	Untrained	27
8.Kodero Mixed	"	"	21
9.Kadibo Girls Sec.	"	"	19.5

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The six Government schools listed above had laboratories which were at least averagely equiped with the demands of the 'O'-level classes. The text books were found to be shared among stuients and each book was shared by four students. They were all district schools, that is, they were taking form one students within the same district. With regardless of other factors it was taken that any difference in Kenya Certificate of Education, (K.C.E), biology results in 1982 possibly came from the way the involved teachers handled their subject matter.

There were differences in percentage pass in biology which was caused by professional qualification of biology teachers concerned. This was evidenced by the fact that four government schools had SI teachers of biology and three out of four of the teachers (75%) filled in their questionnaires that they usually had problems with curriculum materials sent to schools from Kenya Institute of Education. They said that certain topics appeared difficult for lower forms. This then implied that they could not restructure the contained guidelines to suit the classes they were teaching. Five of the government schools visited had graduate teachers who showed no problems with the sent curriculum materials.

The lack of technique in transfering curriculum guides into classroom lessons may cause lack of confidence in the teacher concerned, in the handling of the content matter. Since there was higher percentage pass in schools with graduate teachers, and who all showed no problem in handling curriculum materials it was then implied that the performance in biology in the listed schools, 1982, had some correlation with professional qualification of the biology teachers involved.

A confident biology teacher with adequate psychology of the child and a vast knowledge of the subject matter would sail through easily because he/she knows the scope of the subject per class such that he/she can stress the important parts of the topic for a particular class. This would help the students to relate the content from one class to the other and this always create in the minds of the students the continuity of the subject which leads to good performance in examinations with other factors kept constant. Such described qualities could be ascribed to graduate teachers in the listed schools in table 4.3 above because they had higher percentage pass in biology, K.C.E 1982, in their schools.

The untrained teachers found mainly in harambee schools had more problems. Firstly, harambee and private schools were found not to receive curriculum guides from Kenya Institute of Education like Syllabi and teachers guides which usually help teachers

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in organising their materials. Secondly, being untrained to handle the students they tended to lack the scope of the subject per class. They then failed to stress the important points in a topic for a particular class due to lack of psychology which would help them understand the mental development of their students. Most of them were found to follow a book chapter by chapter and went into details depending on the text book used. Such a teacher handles a topic to the same depth with regardless of the class involved. This was evidensed when some note books were observed from different schools by the investigator. All these could explain the cause of very poor performance in harambee schools.

Taking into consideration that harambee schools in the country enrol 60% of the total student population in secondary schools[4] it becomes a great pity to imagine that every year 60% of the country's youth in secondary schools are exposed to circumstances that lead them to dark future.

Qualification of teachers in harambee and private schools had been very pathetic in the past when such schools were employing ex-form fours who had failed in such subjects and were expected to prepare the students for the same subjects. The problem was solved early this year when the permanent secretary in the Ministry of higher Education, Mr. Arap Leting, directed that private and harambee secondary schools were only allowed to employ school leavers with at least one principle pass in Kenya Advanced Certificate of Education or its equivalent to teach in secondary schools.[5]

2: <u>The effects Laboratory facilities and text books have in the teaching of biology.</u>

(a) <u>The effects of laboratory facilities in the teaching of biology.</u>

In the course of the research different schools were visited during which time the biology teachers and the laboratory assistants were given questionnaires to answer. The questionnaires seeked the information about the availability and usage of the laboratory facilities that existed in their schools. The biology teachers and the laboratory assistants were asked to list down some of the desirable laboratory facilities for the effective teaching of biology at ordinary level but were lacking in their schools. The investigator through the observation of the available laboratory facilities and by the help of the biology teachers and laboratory assistants grouped the laboratories in the visited schools in the following categories:

(i) well equiped with regard to the demands of 'O' level

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(ii) Averagely equipped.

(iii) Poorly equiped for 'O'level demands.

It was found that most government schools had some kind of laboratory and harambee schools did not have any special rooms for teaching sciences. The 'A'level schools with biology at 'A'level had very well equiped laboratories regarding the demands of 'O'level students, like Homa Bay Boys High. Other schools with science upto 'O'level had relatively well equiped laboratories like Mbita boys high. Some other schools with science upto 'O'level had averagely equiped laboratories like Gendia and Agoro Sare high schools. Similarly some few government schools had only special rooms for keeping few laboratory equipments but had no laboratories like Kokuro and Kanya Konga secondary schools. On the other hand harambee schools like Kadika and Kokuro secondary had no special rooms for sciences, every subject was done in classrooms.

Some few Government schools which had the same type of teachers professionally and relatively the same types of text books but different laboratory facilities were chosen. The Kenya Certificate of Education, biology performance in 1982 in such schools was matched with the status of the laboratories in the same schools. Any difference in the biology performance was assumed to have been caused by the available laboratory facilities. Table five below shows the relationship between the available laboratory facilities and Kenya Certificate of Education, biology performance in 1982 in some chosen schools.

Table five:

The relationship between the laboratory facilities and the performance in Biology at K.C.E. level in 1982.

The school	The status of the school	Availability of the laboratory	Equipment of the school	Mean in Biology 1982
1.Ogande girls	Government	General lab. for all sciences	Well equiped	72.4
2.Homa Bay high	"	Special Biology lab.	Well equiped	72
3.				
4.		"	"	69.7
5.	"			
6.				

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In the listed schools above, first four schools had graduate teachers with similar text books. The difference in performance in biology came directly from the available laboratory facilities. The fifth school had no laboratory but just a special room for keeping the few equipments in the school and the last school which was harambee school had no equipments for teaching sciences.

From the table it can be evidenced from different schools that the availability of laboratory facilities had effects in the performance in Biology in 1992 Kenya Certificate of Education examination. This then meant that the available laboratory facilities had effects in the effective teaching of biology in the listed schools. The schools with well equiped laboratories had higher percentages passes in biology while those with averagely equiped laboratories had relatively lower percentage passes. Similarly those with relatively poor equipments like those with no laboratories had very poor performances while harambee school with no equipment had the lowest extreme percentage pass.

Biology is a science subject which consists of a practical paper. During the exams the students are expected to handle the laboratory facilities on their own in doing some simple confirmatory experiments like food tests. This becomes possible mainly when students watch the apparatus involved during their lessons otherwise it may not be realistic for the students to meet such experiences for the first time during the examination.

Generally the availability of laboratory facilities makes the teachers integrate their approaches to different topics in biology. This helps the students to confirm the theory when substituted with some practical lessons. It has been observed that when students see the arrangement of the apparatus for any relevant experiment it becomes very easy for them to remember the concepts involved. Having used the facilities in the laboratories the students can demonstrate their knowledge by improvising some apparatus in their everyday life because science is not restricted to the laboratories nor schools alone.

Practical paper at 'O'level constitutes 20% of the total marks and this is a substancial percentage that students should be well prepared for. It has been observed that students who do better at practical exams handle the theory papers even better for practicals are there to confirm or verify the theories learned in the classrooms.

Since the aim of the Government is to prepare the young scientists it would be for the students be grossed to elementary apparatus at 'O'level in order to pave ways for more advanced concepts in higher levels for this would make them to

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more confident future scientists with good command over the apparatus he/she is expected to use.

(b) The effects of biology text books in teaching of biology.

In this aspect both the biology teachers and the form four biology students were served with questionnaires that seeked for information regarding the types of text books they were using. The students were further asked whether they were sharing the given text books and they were, to indicate the number of students sharing one book.

Some schools were chosen which had the same types of teachers and laboratory facilities. The performance in biology in K.C.E in 1982 was matched with the available books and conditions under which such books were being shared by the students. Table six below shows the relationship between the existing text books in schools and the performance in Biology in the same schools.

Table Six:

The effects text books have in performance in Biology, K.C.E. 1982.

School	Status of the school	Types of text books available for-		No. of students sharing one book	% pass in biology
		Teacher	Student		
1. Kamagambo high	Private (Missionary	8	5	No sharing	84
2. Asumbi girls	Government	4	3	5 students per a book	64
3. Agoro Sare	Government	4	3	6 students per a book	61.7
4. Dr. Agrey Sec.	Harambee	3	2	8 students per a book	32
5. Kadika girls	Harambee	2	1	10 students per a book	15.6

In almost all schools visited the text, introduction to biology was available to students and teachers. Some schools accompanied it with New Biology for tropical schools by Stones and Cozens. Other schools had had Modern Biology by Gholla and Co, but very few schools had the new integrated book, Biology, Integrated approach by Soper and Smith which was found to be available to students at Kamagambo and some High Schools. Other schools like Asumbi had it as teachers' reference copy while other schools did not have it at all. In certain schools mainly Harambee ones even the teachers were not aware of the existence of that book.

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The major problem observed was the number of students sharing one book. If so many students share a book some can go for over a week without seeing the book. Since most schools lack the school library with relevant text books it becomes difficult for students to do their private studies without the text books.

The table six above gives the impression that the more the number of biology text books available to the teachers and students and the fewer the students sharing one book the better the performance in biology at 'O'level examination. This was evidenced by results at Kamagambo high school where there were variety of text books and students were not sharing books. The performance in biology in K.C.E. 1982 was 84%.

The major purpose of the text books in the teaching and learning of biology is, to help the students arrange or organise the facts they gain in their theory lessons and the concepts demonstrated in practical classes in order such that the continuity in the subject content can be realized. Most authors have different approaches to different concepts in the biological science so the availability of different text books can help the enquiring students to compare the approach used by her/his teacher and those used by different authors. The student's personal synthesis from all the described sources would give him/her a more refined material which can always be recalled when need arises during examinations. It has been observed that notes made by individual students during their private studies stick more in their brains than those thrown to them by teachers in classrooms. Personal notes stick better because the student concerned uses some of her/his personal intelligence in framing his/her statements. Such statements can be recalled easily during examination because the students concerned were responsible for framing them unlike the notes given by the teachers which usually portray the teacher's views as the students passively take such views to use in examinations, this makes them forget most of the facts for they are not the students' own views.

The students' intellectualism can only be brought into picture when they have other sources of information apart from the teachers' notes. The teachers should be in close contact with books which should be shared to the extent that each student has good access, at least once in two days if not daily. This would provide the cause of high percentage pass at Kamagambo High school where students were not sharing books.

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CHAPTER FOUR

SUMMARY AND CONCLUSIONS

A: SUMMARY:

The Government has been emphasising the relevance and importance of science a subjects like Biology for the agricultural and technical developments of the country. It has been observed that most employers of the ordinary level school leavers always stress credit passes in sciences and currently most of the post secondary colleges like Agricultural Colleges are science based. All these show current demands for scientists for the economical development of the country.

Despite all the above listed important facts about the importance and relevance of science subjects it has been observed that students usually perform poorly in science subjects like Biology at Kenya Certificate of Education level. The investigator chose to investigate some of the factors affecting the teaching of biology which is currently taken as a compulsory science subject in all secondary schools in the country because:-

(i) Biology is a science subject that leads its scholars into fields like medicine, veterinary, forestry, agriculture all of which form the base of the country's economy.

(ii) Since biology is a major science subject in most secondary schools it was found that harambee schools that have 60% of the country's enrolment at secondary level do poorer than government schools. It was then the hope of the investigator that the study would come up with some findings that would help the performance of science in harambee schools so as to help the future life of the 60% of the Kenyan Youth in such schools.

(iii) It is the Kenyan Education system policy to grade the schools depending on their performance in sciences among other reasons. The findings of the study could then make the performances in schools which have not been graded be better and such schools could then be graded.

In addition to the above listed justifications of the study the investigator had the following objectives underlying the study:-

(i) To investigate the effects the professional quality of biology teachers had in the teaching of biology.

(ii) To investigate the effects of laboratory facilities

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Different questionnaires were designed depending of the expected information from different kinds of target population like biology curriculum developer at Kenya Institute of Education; the headteachers; Biology teachers; laboratory assistants and the form four biology students in secondary schools.

The investigator wrote and posted letters to curriculum developer and headteachers of twenty schools in South Nyanza District, ten government and ten harambee schools in which the the investigation was to take place.

The schools were then visited on different days administering the questionnaires to various relevant target population and getting desired information by the questionnaires. The questionnaires to the curriculum developer was posted to Kenya Institute of Education and the reply was received later on.

B. FINDINGS:

In the whole exercise there were two basic objectives of the study:-

(i) To investigate the effects the professional qualification of biology teachers has in the teaching of biology.

(ii) To investigate the effects the laboratory facilities and the biology text books have in the teaching of biology.

With regard to the first objective, concerning the teachers' professional qualification and the teaching of biology, about nine schools which had the same laboratory facilities and some different types of biology text books were chosen and the teachers' professional qualifications were matched with biology performance in 1982 Kenya Certificate of Education in their respective schools.

It was found, according to table four in chapter three above, that schools which had graduate teachers had better performance than schools with S1 and below teachers. This was supported by some information received by the investigator regarding the problems teachers meet in using curriculum materials sent from Kenya Institute of Education. It was learnt that [illegible] of the S1 teachers met during the investigation had problems with the materials from Kenya Institute of Education. They claimed that some of the proposed topics to teach [illegible] were difficult in the understanding of the students at that form. This was viewed by the investigator as if such teachers had failed to restructure the information carried in the curriculum materials to suit the understanding of their students.

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This view was taken because the investigator had learnt from the biology curriculum developer, who is the secretary of the biology national panel, that the topics were prepared by national biology panel which had members who had taught biology for several years, some of whom were SI teachers. There were no problems found with graduate teachers regarding the usage of the sent curriculum materials. The untrained teachers found in harambee secondary schools had various problems ranging from lack of supportive materials from curriculum centre to their personal inefficiency in handling secondary school students because of being untrained. The harambee schools were found to perform very poorly in sciences.

The first part of the second objective of the study sought the effects of laboratory facilities in the teaching of biology. In the course of the study it was learned that schools visited had the following categories of laboratories regarding the teaching of biology:-

(i) Special biology laboratory occupied by only biological facilities. These included schools which had 'A'level science classes whose laboratories were well equipped with regard to the demands of the 'O'level classes.

(ii) General laboratory where all science subjects like physics, chemistry and biology were being conducted. Some few schools had well equipped laboratories with biological equipments. Most of such schools had averagely equipped laboratories for the teaching of biology. These included schools with 'A'level arts subjects and other ordinary level schools.

(iii) Some government schools without modern laboratories had some special rooms where they keep the few equipments they had for teaching sciences. These included mainly young schools and very few senior or old and well maintained harambee schools.

(iv) Some schools, mainly harambee, had neither the school laboratories nor special rooms for keeping science equipments. This meant that such schools had no equipment for teaching science subjects.

The effects of the laboratory facilities in the teaching of biology was viewed when some schools which had the same status of biology teachers profession also and relatively the same biology text books, but only different in the equipment of their laboratories. The status of the laboratories in such schools were matched with the biology performance in the Kenya Certificate of Education. The hope was that the difference in performance in such schools was due to the difference in availability of laboratory facilities. The findings were tabled in table 4.1 to show these clearly.

Table 4.1 gave the impression that, schools with well equipped laboratories had better performance in biology than schools with averagely equipped laboratories. The schools which did not have laboratories had very poor performance like harambee schools.

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The availability of Laboratory facilities was found to help the students to understand certain concepts learned in theory classes because practicals help them confirm the theories they get in classrooms. After practical lessons when some theoritical concepts have been verified the students become more convinced and confident with scientific beliefs so they face examinations with alot of confidence.

The second part of the second objective seeked the effects of the availability of biology text books in the teaching of biology. During investigation it was found that schools had variety of text books. Some schools had more different text books while others had one to two different text books available to the students. Biology teachers were found to have different reference books.

Among the students some schools were found to share the available text books. The sharing of the text books ranged from one to ten students per a book. Only one school out of twenty had its students not sharing any book. Most schools had about four students sharing one book while some schools had very few books which were being shared among ten students per book.

The available books to students and to teachers and the conditions of sharing such books were matched with the biology performance in 1982 Kenya Certificate of Education in some chosen schools. Few schools were chosen for this because they had the same types of biology teachers and the laboratories of the same status in facilities. The findings were tabled in table six in chapter three above.

From table seven it was found that schools with variety of books which were being shared among very few students had higher percentage pass in biology, and that the school which had enough books for its students, that is, the school where students were not sharing books had the highest percentage pass and the schools which had eight to ten students sharing one book had very low percentage pass.

The students which had more time with the text books did better because they had variety of sources of information from which they could synthesize their own notes which they could understand better and this was shown by their good performance in biology at 'O'level examinations.

C: CONCLUSION:

Following the stated significance of the study in chapter one above, the investigator decided to construct the investigation regarding the effective teaching of the only compulsory science in most secondary schools, Biology.

On the basis of the findings and the time available for the study it becomes realistic for the investigator to sum-

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rict the scope of the study and to choose on the major objectives stated in chapter one above. Further more the financial and time limitations forced the study to be conducted in South Nyanza District only.

From the findings on the first objective: The effects of the professional qualifications of biology teachers on the teaching of biology, it was found that the more professionally qualified teacher a school had the better the performance in biology at Kenya Certificate of Education of the students in such a school keeping other factors constant. This was evidensed when it was found that the schools with graduate teachers had no problems in handling laboratory facilities and curriculum materials sent from Kenya Institute of Education, and hence they had higher percentage pass in biology. This therefore confirms that professional qualifications of biology teachers have alot of effects in the teaching of biology for the higher the professional qualification of the teacher concerned the better the performance in biology by the students of such a teacher.

The findings of the first part of the second objective regarding the effects of the availability and usage of the laboratory facilities on the teaching of biology gave the impression that the schools which had laboratories had better performance in biology than schools without the laboratories at Kenya Certificate of Education examinations. Further more, the schools whose laboratories were well equiped had better performance than those with averagely equiped laboratories. This then implied that the availability of the laboratory facilities in the schools had some effects in the teaching and learning of biology for this was verified in the performance of the students in biology. The better equiped the laboratories are the better the performance of students using such laboratories in biology at Kenya Certificate of Education level keeping other factors constant.

The second part of the second objective dealt with the effects of the availability of biology text books in the teaching of biology. It was found that schools which had many different types of text books available to teachers and students, and where so many students were not sharing books had better performance in biology than the schools where many students were sharing a book. Schools where so many students were sharing a book made the students to have little time with books and were forced to rely on the teachers' notes wholly for their performance in examinations, and such students had poor performance. This therefore implied that the availability of text books made the students to have better performance in their examinations. The more different text books a school has the better the performance of students in such schools in biology at Kenya Certificate of Education taking other factors to be constant.

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From the findings of the study the investigator found it necessary to put forward the following recommendations to the bodies concerned for some possible considerations:

(i) The Kenya Institute of Education, through the National biology panel, should see into it that all the Secondary Schools in the country which usually take the same National examinations should be supplied with the syllabuses and teachers' guides. This was found important because it was learnt that the harambee and private schools which had most of their teachers untrained were not being supplied with supportive materials like syllabuses.
They were found to rely on the syllabus regulations produced by Kenya National Examinations Council annually - which lacked some minor details in some subjects. Since the teachers in such schools are untrained they deserve the provided teachers guide and syllabuses from the curriculum centres which are more simplified and can easily act as the schemes of work to such teachers. This would be the greatest contribution the government would have to the private and harambee schools in the country.

(ii) The current teachers guides sent to schools, although they look comprehensive, can sometimes confuse some teachers in poor schools. This is because almost every topic has a list of different reference books most of which are not available to the young schools. It would be better to take into consideration of the possibilities of getting the text books by some schools.

Curriculum developers are therefore asked to follow their plan used in the preparation of the 'A' level biology teachers guides where they have given the list of some basic books a school or a teacher should have. Although other references could be put forward it becomes easier because most of the references are available in these basic text books recommended to schools.

(iii) Since it was learnt from the biology curriculum developer that the institute has not developed ways of getting feedback from the teachers using their materials it would be better for the National biology panel to have district or provincial seminars by inviting biology teachers to such seminars such that they exchange ideas regarding the usage of the materials. This would be important because it was learnt that a good percentage of the teachers had problems and this highly affects the performance of students because the teachers find it difficult to use the good materials from the curriculum centres which usually form the basis of the national examinations.

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APPENDIX ONE

QUESTIONNAIRE TO THE BIOLOGY CURRICULUM DEVELOPER

1. Academic qualification of the curriculum developer:
   a) K.A.C.E. (MACE) ☐
   b) University ☐
   c) Other (Specify ☐

2. Professional qualification of the curriculum developer:
   a) S-1 teacher ☐
   b) Approved teacher ☐
   c) Graduate teacher ☐

3. Total teaching experience before joining curriculum development at K.I.E. in years: _____

4. How many years during your teaching profession did you prepare students for "O"-level examinations? _____

5. Number of years you have taken at K.I.E. _____

6. Describe briefly how you organise the preparations of biology curriculum materials to be sent to schools: _____

7. List the curriculum materials that are sent to schools from the Institute: _____

8. Describe and assess the dissemination routes taken by biology curriculum materials from the Institute to schools: _____

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9. Do you receive feedback from teachers of biology about the usage of the materials sent?

YES ☐
NO ☐

If the answer to Question 9 above is "Yes", answer Questions 10 - 11; if the answer is "No", jump to Question 12 below.

10. What constraints do teachers experience when using the materials from the Institute?

.....

.....

.....

11. What steps does the Institute take in order to solve such problems in Question 10 above?

.....

.....

.....

12. How do you arrange for feedback from biology teachers in schools regarding the usage of the curriculum materials?

.....

.....

.....

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QUESTIONNAIRE TO THE HEADTEACHERS

1. Name of the school: _____

2. Schooladdress: _____

_____

_____

3. Is the school

a) Government ☐

b) Harambee ☐

c) Private ☐

4. Is the school

a) All boys ☐

b) All girls ☐

c) Mixed ☐

5. Total enrolment of the school currently _____

a) Boys _____

b) Girls _____

6. How many streams does each class have?

Form 1 _____

Form 2 _____

Form 3 _____

Form 4 _____

7. How many biology teachers do you have in the school? _____

8. Do you have the correct number of biology teachers according to the Ministry regulations? _____

9. What are the academic qualifications of the biology teachers in the school?

a) K.C.E. (MAC): _____

b) E.A.C.E. (MAAC): _____

c) University: _____

d) Other (specify): _____

10. What are the professional qualifications of the biology teachers you have?

a) M-I teachers: _____

b) Approved teachers: _____

c) Graduate teachers: _____

d) Untrained teachers: _____

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11. What are the academic and professional qualifications of the Form IV biology teacher?

Academic	Professional	
1. K.C.E.	- - - -	- - - - - - - -
2. K.C.E.	S-1	- - - - - - - -
3. K.A. C.E.	S-1	- - - - - - - -
4. K.A.C.E.	Approved teachers	- - - - - - - -
5. University	Diploma	- - - - - - - -
6. University	Graduate	.....

12. How long has the Form IV biology teacher taken in the profession, in years?
- - - - - - - - - - - -

13. How long has he taken in this school? - - - - - - - - - - - -

14. What other school activities does he engage in?
- -
- -

15. In what ways do you involve the community in the learning activities in your school? List as many as there are?
- -
- -
- -

16. In 1982, how many students from this school sat for K.C.E. ? - - - - - - - -

17. How many of the 1982 candidates obtained places in Government and private High Schools in Form V?

a) Government schools: - - - - - - - - - -

b) Private schools: - - - - - - - - - -

18. Basing the argument on the school results from 1980 up to 1982, what can you say about the percentage pass in biology, C.R.E and History comparatively?

	Biology (Science)	History	C.R.E. (Arts)
1980	- - - %	- - - %	- - - %
1981	- - - %	- - - %	- - - %
1982	- - - %	- - - %	- - - %

- - - - - - - - - - - - - - - - - - - -

19. What do you think caused such percentages in Question 18 above?

1980: - - -

APPENDIX THREE

QUESTIONNAIRE TO THE BIOLOGY TEACHERS AND LABORATORY ASSISTANTS:

1. Name of the school: -

2. Is the school

a) Government ☐

b) Harambee ☐

c) Private ☐

3. How many streams are there in Form IV? - - - - - - - - - - - - - - -

4. How many students are there per class? - - - - - - - - - - - - - - - -

5. Does the school have a laboratory? Yes ☐

No ☐

N.B. If the answer to Question 5 is yes, then answer Questions 6 - 12 below:

6. Does the school have a laboratory assistant? - - - - - - - - - - - - - -

7. What is the qualification of the laboratory assistant in your school?

- - - - - - - - - - - - - - - - - - - -

8. When was the laboratory built in this school? - - - - - - - - - - - - - -

9. List some of the biological facilities that are available in your laboratory:

- -

- -

- -

- -

10. List the laboratory facilities which are very desirable for effective learning of biology, but are missing in your school laboratory:

- p

- -

11. How do you get supplies of laboratory facilities? - - - - - - - - - - - - - - -

- -

12. Since 1980 how many times have you received new orders of laboratory facilities?

- -

N.B. If the answer to Question 5 above is "No", then answer Questions 13 - 19 below:

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13. Where do you conduct the biology classes?

a) classroom

b) special biology room

c) under a tree

d) any other (specify)

14. Which particular facilities does your school have for teaching biological science? - - -

21. Do you have problems in receiving textbooks in time?

YES ☐
NO ☐

22. Since 1980, what kinds of curriculum materials have you received from the Kenya Institute of Education?

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23. Do you experience any problem in using the curriculum materials sent to your school?

YES ☐
NO ☐

24. List any problems you have been experiencing in using the curriculum materials sent from K.I.E.

---

25. If the answer to Question 23 is Yes, what have you done to solve the experienced problems?

---

26. List any other problems you have experienced in conducting biology classes in this school or any other school you have been to

---

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27. Do you believe that students do better in arts subjects, like G.H.E. than in biology?

YES ☐
NO ☐

28. If the answer to Question 27 is Yes, then can you list some of the reasons for such outcomes?

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APPENDIX FOUR

QUESTIONNAIRE TO FORM FOUR BIOLOGY STUDENTS

1. Name of the school: _____

2. Is the school
   a) Government ☐
   b) Harambee ☐
   c) Private ☐

3. How many biology teachers do you have in the school? _____

4. Since 1980 has your class ever missed a biology teacher?
   Yes ☐
   NO ☐

If the answer to Question 4 is "Yes", then answer Questions 5 and 6 below:

5. For how long did you stay without a biology teacher? _____

6. What were you doing as a class during biology lessons?

   _____

   _____

7. How many types of biology textbooks do you have?

   _____

8. Are you sharing these textbooks with other students?
   YES ☐
   NO ☐

9. If the answer to Question 8 is "Yes", then how many students share one book?

   _____

10. List the titles of the biology textbooks you have been given this year:

    _____

    _____

    _____

    _____

11. Does your school have a laboratory?
    YES ☐
    NO ☐

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If the answer to Question 11 is "Yes", then answer Questions 12 - 14; if the answer is "No", proceed to Questions 15 - 16 below.

12. How many periods in a week do you study in the laboratory?

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13. How well equiped, averagely, is your school laboratory?

---

14. What facilities are lacking in your school laboratory that are desirable for biological studies?

---

15. How do you conduct biology classes in the absence of a laboratory?

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16. Do you have a special room for biology classes?

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17. List any other factors which affect the learning of biology in this school.

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FOOTNOTES:

1. An advertisement on recruitment of students to agricultural colleges on daily nation newspaper on 20th May 1983.

2. Mr. Karagu Nelson, " Nature and effects of change", One of his lectures on curriculum implementation during the residential phase in Nairobi, on 15.02.83. A lecturer in the department of Educational Administration, planning and curriculum development, Kenyatta University College - Kenya.

3. Ibid

4. Ibid

5. Mr. Arap Leting," Ps directive on Secondary School teachers". Press interview on 05.02.83. daily Nation of Permanent Secretary in the Ministry of Higher Education - Kenya.

6. Mr. Aol Eliud, " Effects of laboratory facilities in the teaching of sciences". Personal interview on 29.06.83. Head of Chemistry department at Nyanga High School - Kenya.

7. Ibid

8. Ibid

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